THE ELECTRICAL WORLD

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Philadelphia and the International Electrical Exhibition.

In presenting our readers with a general plan of the charming city of Brotherly Love, it is our aim to furnish those who contemplate a journey to the Quaker City next fall with an opportunity to study up the situation in advance. Among the many people in foreign countries who will make the journey there are no doubt a few who know but little of Philadelphia, with her round million of inhabitants, her institutions of learning, her vast manufactories, and her noble river, which, though 120 miles from the sea, sweeps by the city a mile wide. Our map shows the point where the Liverpool and other European steamers touch the city, while the locations of the various railroad depots and the hotels are plain enough to permit a stranger to form a fair idea of the places he is to visit, see or reside at temporarily.

The forthcoming exhibition will be the grandest of the kind the world ever saw, and we propose to keep equal pace with it. No item of interest shall be lost, and, in describing the progress of the exhibition building and its surroundings we shall from time to time describe incidentally much of Philadelphia itself and the *personnel* of her workers in the electrical field.

We suggest, therefore, that our readers at home and abroad preserve these numbers carefully, to the end that they may not be strangers when they reach Philadelphia.

Our map of Philadelphia shows the site of the forthcoming World's Electrical Exhibition, as well as its position with regard to the principal hotels, railway stations, telegraph offices, and institutions interesting to scientists.

The plan of the city lying between the Delaware and Schuylkill rivers may readily be seen, Broad, or Fourteenth street, running north and south, and Market street running east and west, dividing the city into quarters. Westward of the Schuylkill River is West Philadelphia.

The interesting points indicated are as follows:

The Electrical Exhibition, Thirty-second street, near Market.

Girard College, Nineteenth street and Ridge avenue.

University of Pennsylvania, Thirty-sixth street and Darby road, West Philadelphia.

Franklin Institute, Seventh street, above Chestnut.

Academy of Natural Sciences, Nineteenth and Race streets.

The Athenæum, Sixth street, near Walnut.

Academy of Fine Arts, Broad and Cherry streets.

Horticultural Hall, Broad street, near Spruce. The meetings of the Society for the Advancement of Science will be held here.

Grave of Ben. Franklin, Fifth and Arch streets.

Independence Hall, where American Independence was formally declared, Chestnut street, above Fifth.

New City Hall, the largest and finest building in America, Broad and Market streets.

Post Office, Ninth and Chestnut streets.

U. S. Naval Hospital and U. S. Arsenal, on the Schuylkill River.

Fairmount Park and the old Centennial Exhibition grounds, West Philadelphia.

Pennsylvania Railroad, Broad Street Station, at City Hall.

Pennsylvania Railroad, old depot, Thirty-first and Market streets.

Reading Railroad depot, Thirteenth and Callowhill streets.

New York depot (Bound Brook route), Ninth and Green street.

Baltimore depot, Broad street and Washington avenue.

West Chester depot, Thirty-first and Chestnut streets.

Aldine Hotel, Nineteenth and Chestnut streets.

West End Hotel, Chestnut, below Sixteenth street.

Colonnade Hotel, Chestnut and Fifteenth streets.

Hotel Lafayette, Broad street, below Chestnut.

Hotel Bellevue, Broad street, below Walnut.

St. George's Hotel, Broad street, below Walnut.

Bingham House, Eleventh and Market streets.

Girard House, Ninth and Chestnut streets (north side).

Continental Hotel, Ninth and Chestnut streets (south side).

Irving House, Walnut street, above Tenth.

Washington Hotel, Chestnut street, above Seventh.

Guy's Hotel, Seventh and Chestnut streets.

American Hotel, facing Independence Hall.

Merchants' Hotel, Fourth street, below Arch.

St. Charles Hotel, Third and Arch streets.

St. Elmo Hotel, Arch street, below Fourth.

Western Union Telegraph, main office, Tenth and Chestnut streets.

St. Cloud Hotel, Seventh and Chestnut streets.

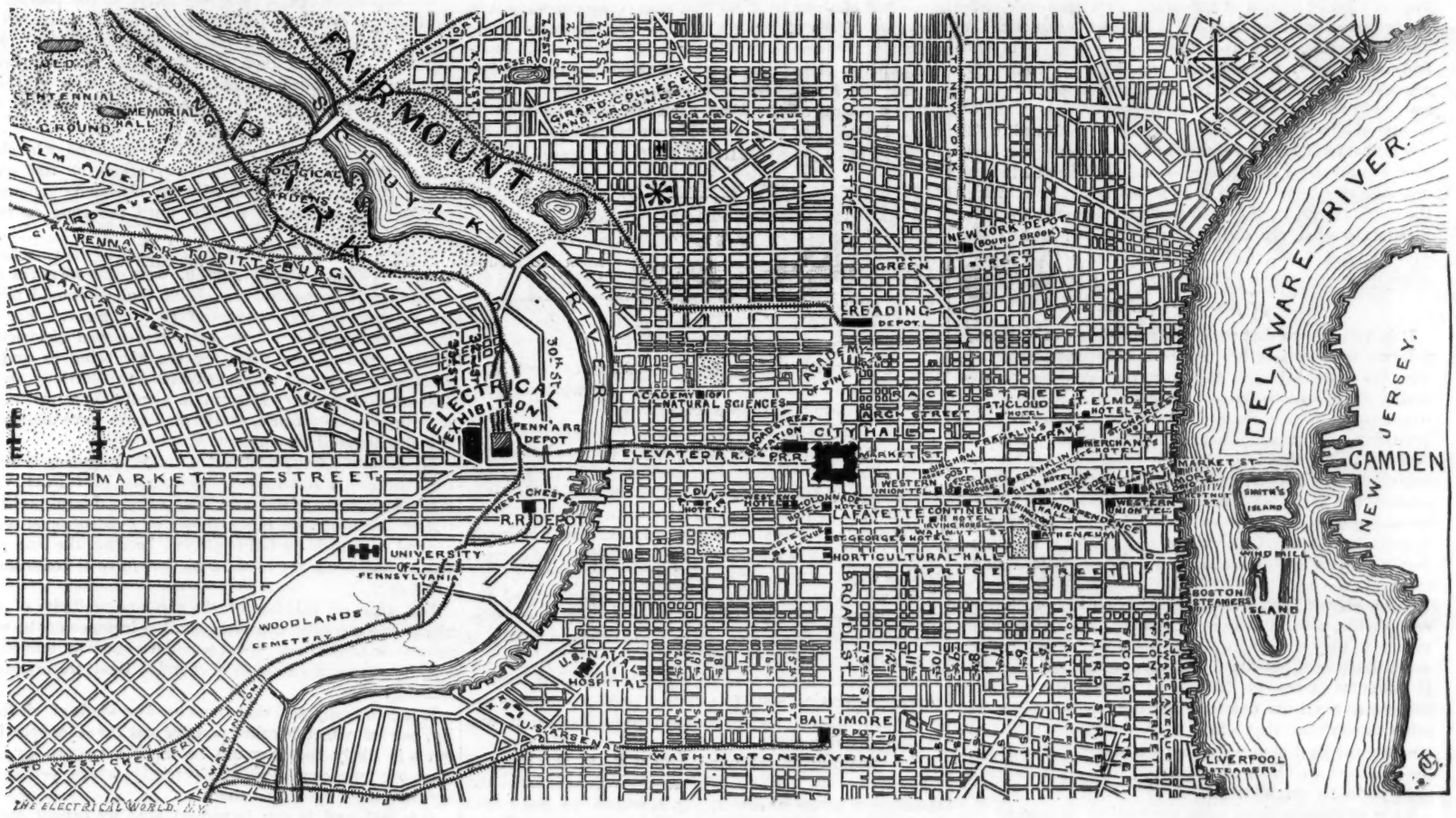
Western Union, down town main office, Third and Chestnut streets.

Baltimore & Ohio Telegraph, main office, Chestnut and Bank streets.

Bankers' and Merchants' Telegraph, main office, Chestnut and Bank streets.

Postal Telegraph, main office, Third and Chestnut sts.

We have received from Philadelphia, as we go to press, a photograph showing the progress of the work on the Exhibition building. The iron framework of the main structure is all in position.



MAP OF PHILADELPHIA, SHOWING THE INTERNATIONAL ELECTRICAL EXHIBITION BUILDING, ETC.

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An Electric Headlight Company.

J. A. Long and Lewis Miller have been, at Indianapolis, says the Akron, O., *Beacon*, of the 17th, participating in negotiations looking to the consolidation of locomotive electric headlight interests. W. B. Raymond, of this city, is also connected with the enterprise, as is also E. L. Babcock, of Cuyahoga Falls. Heretofore there have been two companies, one with headquarters at Dayton, and the other with headquarters at Indianapolis. The conference of Tuesday resulted in their consolidation and the incorporation, under the laws of Indiana, of the American Locomotive Electric Headlight Co., with a capital stock of $6,000,000. The directors are Lewis Miller and J. A. Long, of this city; E. L. Babcock, of Cuyahoga Falls; Leonard Moore, J. W. Carpenter and J. W. Stoddard, of Dayton, George N. Wheeler, H. H. Fulton and M. N. Linn, of Indianapolis. Mr. Miller is President, Messrs. Carpenter and Wheeler, Vice-Presidents, Mr. Moore, Secretary, and W. B. Raymond, of this city, Treasurer. The new company will control the Woolley, Linn and other headlight patents, and as the directors are all Dayton, Akron and Indianapolis men, their works will probably be at one of these three points.

The Cleveland *Herald* says of the new company's patents: The Indianapolis and Dayton Electric Headlight companies have consolidated. They have a very much patented device, if one is to believe one of the company who says: "We have 5 patents on the lamps, 3 on the engines, 13 on appliances and 52 claims for improvements."

The Theory of Magnetism.*

BY PROF. D. E. HUGHES, F.R.S.

(CONTINUED FROM PAGE 118.)

Inertia.

I have remarked in my researches that the molecules have true inertia, that they resist being put in motion, and if put in motion will vanquish an opposing resistance by their simple momentum. To illustrate this I take this large ¾-in. bar and magnetize it so that its south pole is at the lowest end. We know that the earth's influence is to make the lower end north. I now gently strike it with a wooden mallet, and the rod immediately falls to zero. I continue these blows, but the rod obstinately refuses to pass the neutral line to become north, the reason being that in so doing it would have to change the whole internal reversed current that I have discovered. It requires now extremely violent and repeated blows from the mallet to make it obey the earth's influence. Let us repeat this experiment by starting the molecule rapidly in the first instant; the rod is now magnetized south as before. I give one single sharp tap, the molecules run rapidly round, pass through neutrality, breaking up its curve, and arrive at once to strong north polarity. (Experiment shown).

A very extraordinary effect is shown if we produce this effect by electricity; it then almost appears as if electricity itself had inertia. I take this bar of hard iron and magnetize it to a fixed degree. On the passage of the current you notice that the magnetism seems to be increased as the needle increases its arc, but this is caused by the deflection of the electric current in the bar. The current is now obliged to travel in spirals, as my researches have proved to me that electricity can only travel at right angles to the magnetic polar direction of a molecule; consequently, in all permanent magnets the currents must pass at right angles to the molecule, and its path will be that of a spiral. Let us replace this bar by one from a similar kind of iron, well annealed. The molecules here are in a great state of freedom. We now magnetize this rod to the same degree as in the previous case. The electric current now, instead of being deflected, completely rotates the molecules, and the needle returns to zero, all traces of external magnetization having ceased. The electricity on entering this bar would have been forced to follow a tortuous circular route; its momentum was, however, too great for the molecules, and they elected to turn, allowing the electricity to pass in a straight line through the bar. Thus, in the first instant, magnetism was the master directing the course of the current; in the last it became its servant, obeying by turning itself to allow a straight path to its electric master. (Experiment shown.)

Superposed Magnetism.

It is well known that we can superpose a weak contrary polarity upon an internal one of an opposite name. I have been enabled thus to superpose twenty successive strata of opposite polarities upon a single rod by simply diminishing the force at each reversal. I was anxious to prepare a steel wire, so that in its ordinary state it would be neutral, but that in giving it a torsion to the right one polarity would appear, while a torsion to the left should produce the opposite polarity. This I have accomplished by taking ordinary soft steel drill wire and magnetizing it strongly while under a torsion to the right, and more feebly with an opposite polarity when magnetized under torsion to the left.

The power of these wires, if properly prepared, is most remarkable, being able to reverse their polarity under torsion as if they were completely saturated; and they preserve this power indefinitely if not touched by a magnet. It would be extremely difficult to explain the action of the rotative effects obtained in these wires under any other theory than that which I have advanced; and the absolute external neutrality that we obtain in them when the polarities are changing we know, from their structure, to be perfectly symmetrical.

I was anxious to show some mechanical movement produced by molecular rotation, consequently I have arranged two bells that were struck alternately by a polarized armature, put in motion by the double polarized rod I have already described, but whose position at three centimetres distant from the axis of the armature remains invariably the same. The magnetic armature consists of a horizontal, light steel bar suspended by its central axle; the bells are thin wine glasses giving a clear, musical tone loud enough, by the force with which they are struck, to be clearly heard at some distance. The armature does not strike these alternately by a pendulous movement, as we may easily strike only one continuously, the friction and inertia of the armature causing its movements to be perfectly dead-beat when not driven by some external force, and it is kept in its zero position by a strong directive magnet placed beneath its axle.

The mechanical power obtained is extremely evident, and is sufficient to put the sluggish armature in rapid motion, striking the bells six times per second, and with a power sufficient to produce tones loud enough to be clearly heard in all parts of the hall of the institution.

There is nothing remarkable in the bells themselves, as they evidently could be rung if the armature was surrounded by a coil, and worked by an electric current from a few cells. The marvel, however, is in the small steel superposed magnetic wire, producing, by slight elastic torsions from a single wire, one millimetre in diameter, sufficient force from mere molecular rotation to entirely replace the coil and electric current. (Experiment shown, by ringing the bells by the torsion of a small $\frac{1}{16}$-inch wire, placed four inches distant from bell hammer.)

(TO BE CONTINUED.)

* Paper read before the Royal Institution, 29th February, 1884.

Electrical Information for Beginners.

BY WM. MAVER, JR.—PART IV.

Electricity and Magnetism.

We should now have a fair idea of the nature of energy and of the various forms of energy, as well as the relation of electricity and magnetism to the other physical forces, and further on we shall, I think, begin to appreciate the benefit of this knowledge.

Let us now consider more closely the relations which electricity and magnetism bear to each other.

The correlation of electricity and magnetism is established; indeed, some writers on electricity classify magnetism as a condition of electricity; just as they would speak of statical or frictional electricity, and while it is true that there are many points of resemblance between these two forces, there are also several points of wide and unexplained diversity, which we should now proceed to discuss.

But before doing so it will be necessary to digress for the purpose of explaining some of the laws and effects of electricity and magnetism which show their resemblances and dissimilarities.

If we take a piece of ordinary glass tube and place it in close proximity to any small detached substances, such as pieces of paper, nothing happens, the glass being in its normal condition; but if we first rub the glass lightly with a piece of cloth or wool, we find that on approaching it to the same pieces of paper that they are now attracted to the glass. When we have brought the glass into the condition which gives it the power of attracting light bodies we say that the glass has become electrified.

The rubbing of the glass has apparently disturbed its normal condition, and has produced in it the force that is

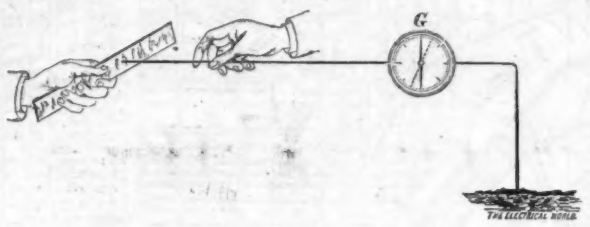


FIG. 7.

termed electricity, technically termed frictional electricity. That the condition into which we have brought the glass contains within it a *force*, can be proved.

To prove it let us have recourse again to a delicate galvanometer. We will suppose that a wire is led from the hand of an experimenter, through the coils of the galvanometer, and that the other end of the wire is placed in the earth, as in Fig. 7.

The needle of the galvanometer being at rest, if it should move, it will be in response to the expenditure of energy, be that expenditure ever so small.

We will now suppose that we have again rubbed the glass; let the experimenter now draw the end of the wire in his hand over the glass as in Fig. 7, and the needle of the galvanometer will be deflected.

Thus we see that by rubbing the glass we had, as it were, raised its electrical state to a certain position, or let us say potential, where under certain circumstances, it was capable of doing work.

The meaning of the word potential, in this sense, is "power to do work." The reader will remember the illustration given in part 2, Fig. 4, where we had raised the barrel filled with water on a table, against the attractive force of gravity. Its position on the table indicated its potential, or power to do work. Had we raised the barrel to a position twice as high, we would have doubled its power to do work, namely, its potential. That the water within the barrel has power to perform work we saw as soon as we opened the faucet and allowed the water to flow. The flowing water moved the wheel, etc. Before we turned the faucet on we termed the force in the barrel static force.

Likewise by rubbing the glass we have raised the electricity to a certain potential, or power to do work, and when we touched it with the wire (opened a faucet, so to speak), the electricity flowed to the earth as was indicated by the galvanometer, the moving of the needle of which by the electricity may be likened to the moving of the wheel by the falling water.

It is thought that this condition into which the glass or other substance has been brought by rubbing it, is caused by a disturbance of the natural equilibrium of the molecules of the substance. The molecules resist the influence and seek the first opportunity to resume their normal positions.

Before touching the glass with the wire the electricity gathered thereon was at rest. Such electricity is therefore called statical electricity. The moment the electricity begins to flow it becomes dynamic electricity. Let us now take a piece of iron of about the same dimensions as the glass and apply the same tests to it. Approach it to the small pieces of paper; no result. Now rub the iron as we rubbed the glass, and again apply it to the papers; still no result.

We are then to assume that iron is not capable of electrification? Not at all. We have simply neglected a necessary precaution to show the phenomenon with iron.

To prove that this is the case, insert over a few inches of one end of the piece of iron a glass tube that fits the iron tightly. Now hold the iron by the glass covered end and again rub the iron, and reapply it to the papers. Now the iron attracts them. This shows that the iron is also capable of becoming electrified.

Why is it, then, that it did not attract the paper in the first place?

This question brings us to consider another feature of electricity, namely: That while all substances may be electrified, they do not all allow the passage of electricity through them with equal facility, and on this account the various substances are classified as conductors and non-conductors.

Non-conductors are technically termed insulators.

Now glass is a very poor conductor of electricity, one of the worst, while iron is, on the contrary, an excellent conductor. Therefore, in the experiment with the glass, when we generated the electricity on any portion of the glass by rubbing it, the electricity remained there.

On the other hand, when, by rubbing the piece of iron, we generated the electricity in it, the electricity immediately passed to the hand and body of the experimenter until the glass handle was used which prevented the electricity from escaping to the body or the earth.

The best conductor of electricity is silver. The next best is copper. Copper is six times better than iron as a conductor.

The opposition that a substance offers to the passage of electricity is called its resistance. Thus, as compared to copper, the resistance of glass is almost infinite. For instance, one mile of glass will offer about as much resistance to an electric current as a copper wire reaching from the earth to the sun, each substance being of the same thickness, etc.

Knowing this fact, it is easy to understand why electricity should remain on those portions of the glass where it is generated, and why the electricity generated on the iron escapes so readily, until the glass cover is put on.

Dry air offers even a higher resistance to the passage of electricity than glass. Indeed, were the air not a bad conductor it is extremely probable that we should never have known of the existence of such a force. For in that event, where could we have imprisoned electricity? certainly not on the glass, for the air being in contact with the glass would have conducted the electricity away. The attempt to carry this subtle agent over wires would have been equally futile, as the air would have dissipated it before it could even get out of a battery.

My attention was first directed to this interesting thought by a paragraph in an article written by Prof. P. H. Vander Weyde, who, at the same time, offered this proposition, "May there not be other forces or conditions at work around us which we fail to discern because the one particular link necessary to show us that force or condition is missing?"

But, after all, this fact of the non-conductibility of dry air, as to electricity, is merely another instance of the wise provisions of Nature What would we know of light without the organs of vision, or of sound without the organs of hearing?

It is commonly said that there are two kinds of electricity, one of which is called positive and the other negative; but it is likely that it would be more correct to say that there are two conditions of electricity, which perhaps is saying almost the same thing.

It is said, and it can be proved, that we cannot obtain one kind of electricity without producing an equal amount of the other kind. For instance, let us suppose that when we rub a piece of glass with wool we generate on the glass a certain amount of positive electricity. If we had carefully insulated the wool from the hand holding it, and equal amount of negative electricity would be found on it.

It is supposed by some writers that when we have produced electricity in a substance we have an excess of electricity, and that when we have produced negative electricity in a substance we have a dearth of it—just as when we speak of a pressure of air, or a vacuum—and that when there is an excess of electricity in a substance the excess will take the first opportunity to escape, thus restoring an electric equilibrium in that substance, and when there is a dearth of negative electricity it will be supplied from some other available source.

It is, therefore, further supposed that a current of electricity is thus formed, as in the illustration given above (Fig. 7), we have an excess of positive electricity; as soon as we provide a good conductor of electricity the excess flows to the earth, the earth being supposed to be a large reservoir either for the reception or the distribution of electricity.

If we should arrange to produce a continuous supply of either positive or negative electricity on the glass, and pro-

vided a conductor, we would have a continuous current of electricity. This is seen in the case of frictional electrical machines, etc.

I might illustrate this point further by again referring to Fig. 4. Let us assume that the amount of water in the barrel corresponds to the amount of electricity generated on the glass by rubbing it. We know that when we open the faucet in the barrel the water will continue to flow and do work only as long as the water holds out, but if we arrange to keep a supply of water in the barrel it will of course flow out indefinitely.

Positive electricity is designated by the plus sign+, negative electricity by the minus sign—.

When the expressions *like* and *similar* signs are used they mean that two positive or two negative conditions of electricity are referred to. The terms *unlike*, *opposite* or *dissimilar* signs refer to one positive and one negative state of electricity.

[TO BE CONTINUED.]

The Electric Light in Toronto.

Under an advertisement for tenders for electric lighting for the streets of Toronto, Canada, tenders were sent in by the Canada Electric Light Company (said to be unformed and unchartered at present) at 62 cents per night, and by the Toronto Electric Light Co. Limited at 65 cents. It is stated that the first named company purpose using the Van Depoele system. The Toronto Electric Light Co. own the Excelsior, or Hochhausen, system for Canada. They made the following proposition to the City Council:

To show you that we are prepared to give the city the best of opportunities to test the merits of the two systems we hereby propose and agree to put up 25 or 50 lights for a period of 30 or 60 days, and let the Canada Electric Light Co. do the same, and then let the city appoint two disinterested experts who shall appoint a third, and whose decision shall be final, with the understanding that the city adopt the one approved of, and that the expense for experts shall be paid by the company that is unsuccessful, while the successful competitor shall be accorded the contract and be paid for the lights furnished during the exhibition or test.

On April 15 the Council passed resolutions instructing each company to put up 25 lights for a period of three months, with the understanding that the company giving the best exhibition should receive a contract from the city for at least fifty lights for a period of one year.

We understand that the Toronto Electric Light Co. Lim. have had 55 lights in operation since September 14, 1883. They have purchased a building three stories in height, 96 × 40, which when completed, by May, will be one of the finest electric light stations on the Continent. The outfit will consist of three steel boilers 6 × 15, each 100 horse-power capacity, with six high speed engines, enabling the company to run 300 arc lights. As soon as their arc light system is completed they will develop the Hochhausen incandescent system to be run from the arc circuit or from independent circuit. The company have been experimenting with the incandescent system for some time, and they now feel that it is so perfect as to give the greatest satisfaction. In view of the numerous and high merits of the Hochhausen system, Toronto stands a good chance of being most brilliantly and economically lighted, even if no other system is tried there.

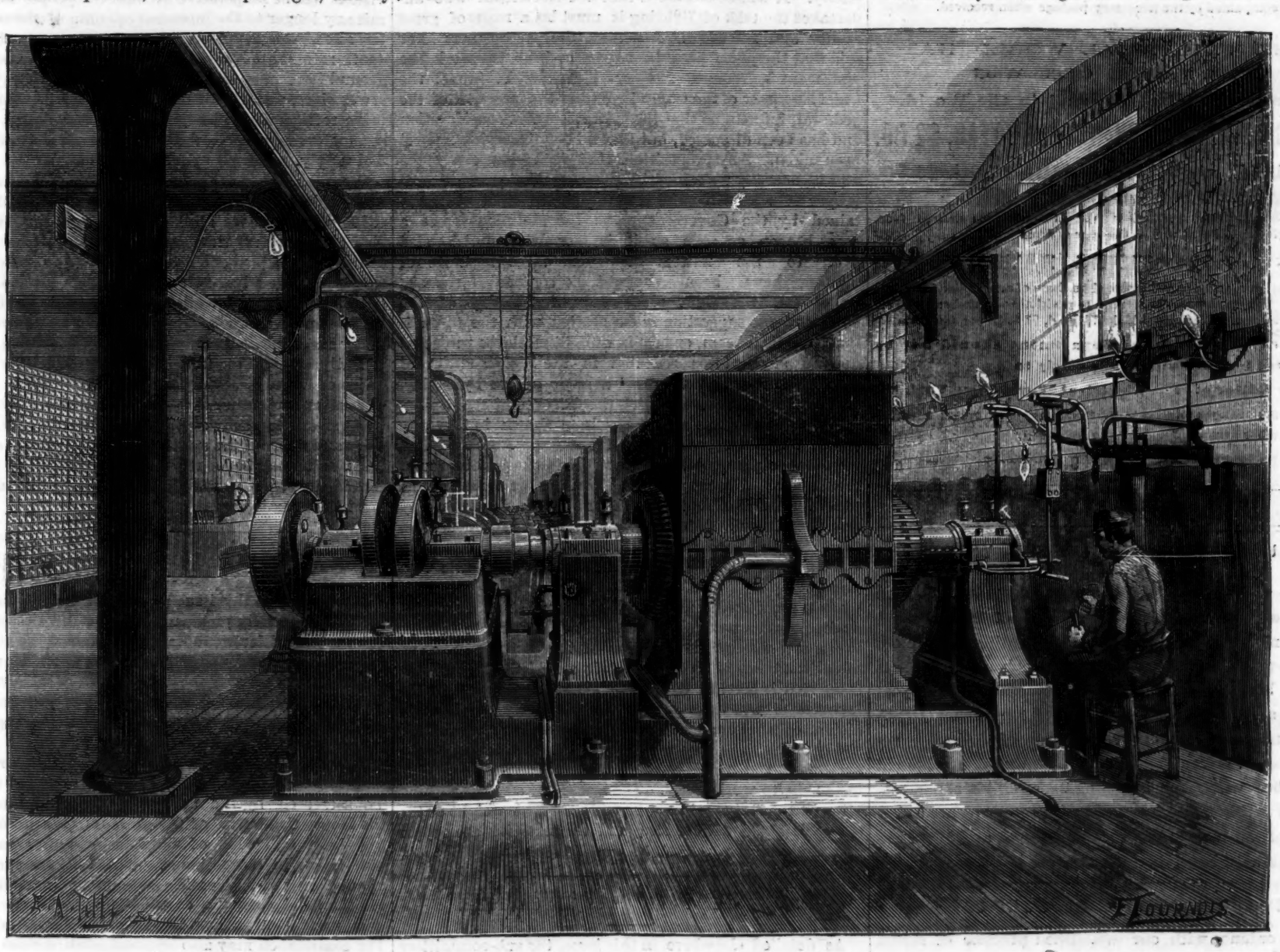
The Electric Light in Theatres.

The time is certainly not far distant when the electric light, though no further reduction be made in the cost of producing it, will alone be used in the illumination of theatres and halls of assembly. Gas, on which the chief dependence has been placed during the last fifty years, is now found to be terribly destructive of paint, decorations, and all that adds to the æsthetic effect of a room, and the fact that a large burner will consume as much oxygen and discharge as much carbonic acid gas as ten people, during the same length of time, is sufficient to condemn gas on hygienic grounds. As Prof. R. O. Doremus said recently: "How astonished we should be if our fashionable salons were heated during the winter season by a hard coal fire in the centre of the room, with no device for the removal of the most prominent product of combustion, the carbonic acid gas. Yet such is our nightly practice when we light our gas-jets and lamps; and our places of public resort, with but few exceptions, afford us the same unwholesome pabulum for respiration." The "few exceptions" are rapidly becoming a majority on the other side for the reason that he gives, that with the electric lights whose introduction we should "gladly hail and hasten," our apartments may be brilliantly lighted without vitiation of the air or the loading it with impurities detrimental to the health of the occupants and the beauty of the furniture.

One of the most remarkable examples of lighting public buildings with the electric light is that given by the recent installation of the incandescent system in the world-famous Theatre de la Scala, at Milan, Italy. This theatre, which is, we believe, the largest in Europe, with the exception of the San Carlo, at Naples, is the largest lighted by incandescent lamps. No illustration is yet obtainable of the interior of the theatre, said by Mr. Edison to be wonderfully brilliant now when the auditorium is illuminated and filled, but we are enabled to reproduce from *La Lumière Electrique* a good view of the dynamo room at the Edison central station, where the current is generated. According to a statement by Prof. R. Ferrini, in that journal, the greatest number of incandescent lamps used there so far out of an available 2,411 was 2,062, during the performances of Verdi's "Don Carlos," and ordinarily the number burning when the theatre is open is 1,600. He says of the result: "The light diffused by the lamps is very agreeable, as well on account of its pure color as of its steadiness. The temperature of the theatre is no longer stifling, as it once was, especially in the upper boxes and galleries, and the air is fresh, now being free from the poisons produced by the combustion of the gas. The decorations, varnished surfaces and gildings are no longer deteriorated by the action of gas, and what is still more important, the dangers of fire are, we might almost venture to say, abolished." Prof. Ferrini justly considers that these merits would more than compensate for any extra expense of electricity over gas, but we note that gas in Milan costs large consumers about $2 per 1,000 feet, and that the price of the Edison light there is, if anything, a little less.

The central station has a magnificent outfit, as our illustration indicates, but we are concerned chiefly with the theatre it lights. We take from *Engineering* a condensed statement with regard to the distribution of the lamps in it. There are 1,000 on the stage, which is the largest in the world, 410 in the auditorium and orchestra, 500 in the vestibules, corridors, foyers and boxes, and the rest in the offices, dancing-school, singing-school, painting-room, etc. The intensity of the light on the stage and in the auditorium is controlled by sixteen regulators, of which eight are for the nine floats, three for the battens, which number thirty-two, two for the foot-lights and three for the great chandelier. These govern 1,114 lamps of 16-candle power each, that is, 408 on the floats, 264 on the battens, 98 on the foot-lights and 344 in the chandelier. These regulators are bobbins of galvanized wire and have a handle moving over a dial with twenty contact pieces corresponding to an equal number of degrees of illumination, from sixteen candles down to two. There are also four portable regulators for the movable lighting apparatus, which can be placed at any part of the stage. These comprise six projectors, having in all ninety lamps, and twelve frames of ten lamps each, designed to be laid on the boards to light the decorations from below. In every case the current is carried by conductors of stranded copper covered with india-rubber, and these are led between the scenery, just as the ordinary flexible gas tubes are. All the lamp carriers are provided with red and blue glasses, in addition to transparent glasses for scenic effects. There are four main conductors entering the theatre, which is at a mean distance of 1,300 ft. from the station, and these conductors supply respectively the stage, the auditorium, the vestibules, and foyers, and the extra scenic effects.

Besides the lamps already enumerated others are being erected for galas and *bal masqués*. They include 53 groups of five each in the auditorium and 400 lamps on the stage



VIEW OF DYNAMO ROOM, EDISON STATION, MILAN, ITALY.

THE

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In accordance with our established practice of laying before our advertisers unimpeachable evidence as to the nature of the circulation of THE ELECTRICAL WORLD, we have published the figures for the current month. The sworn statements of the publisher, supported by the certificates of the business manager, the superintendent of the press-room, and the manager of the mailing-room, show that the circulation for the first two weeks of April was 10,000 per week, and that the circulation last week was no less than 10,500 copies. We have distributed this sworn statement to advertisers, and will take pleasure in sending free a copy to any of our readers who may wish to have it.

LIGHTING THE STATUE OF LIBERTY.

The high appreciation in which the electric light is held is shown very strikingly by the fact that it alone is considered worthy or suitable to illuminate conspicuous and beautiful public buildings. It would be impossible to numerate all the fine edifices in or outside of which the electric light is now used exclusively, and the number is daily on the increase. Thus it happens that only the electric light is thought of in connection with the great Bartholdi Statue of Liberty given to this country by the French people. Already the newspapers have got hold of the subject and are expressing opinions about it. One paper, determined to be foremost in giving the news, says that "the electric light to be held aloft by the statue will be the largest and most powerful in the world." The writer evidently believes that one light only will be used, and he adds: "It is designed to illumine the lower bay and even to make Coney Island, which with its myriads of lights glistens on a summer's night like a huge diamond, pale and insignificant, and like the evening star when the moon is in full form." All of which is very interesting and poetical, but it lacks accuracy.

The design of the statue is so well known to everybody that it does not need reproduction to illustrate our remarks on the subject. The dimensions are not generally known, however. The pedestal proper will be 114 feet high to the base of the statue, and will stand on a high terrace of Bedloe's Island, in the centre of old Fort Wood. The height of the statue from the base of the figure to the top of the torch carried aloft in the right hand is 151.14 feet, or to the top of the diadem 116.44 feet. The length of the head is 14.43 feet, the eyes are each 2.13 feet wide, and the length of the nose is 3.67 feet. Perhaps a better idea will be formed of the size of this gigantic statue when we state that forty persons can find standing-room in the head, and that twelve persons can stand together on the torch, access to which is gained inside the arm.

Such is the colossal figure that is to dominate the entrance to New York Harbor and be lighted by electricity. It will be admitted that the electrician who undertakes the task of lighting it must be a man of great ability and resources. Although the newspapers have said that the plans have been prepared for the work, the statement is premature. General Charles P. Stone, the Chief Engineer of the Commission for the erection of the pedestal, informs us that the matter is under consideration and has been discussed, but that no definite action has yet been taken. Any propositions that electricians can make will be heartily welcomed by the Commission, still it is proper to state that the lighting service will be maintained by the Government, as the statue becomes a coast beacon as soon as it is completed and handed over to the nation. Two or three methods of lighting have been thought of. The torch is, of course, the right place for the display of the light, and one suggestion in connection with the torch is that a vertical beam, or beams, of light might be projected upward so as to be reflected in the higher strata of the air and thus be visible as "a pillar of fire by night" far beyond the range at which the direct light could penetrate. It is said that a light has been shown in this way from a Russian beacon on the Black Sea. Another plan, not quite so grandiose, is to place lights like jewels around the diadem. A third plan is to place some lights at the foot of the statue, in the loggia or above it, in such a way that the rays will all be thrown upward on the statue, and thus the illumined face of Liberty will shine out upon the dark waste of waters and the incoming Atlantic voyagers.

Like the Brooklyn Bridge, therefore, the Bartholdi statue presents peculiar and difficult conditions to be met. It seems to us that the vibration of the statue will be one important element to be taken into consideration. Everything that is possible will be done to secure it against the leverage of wind pressure, but the rigidity obtained by means of anchorage rods sufficient to keep the statue stably on its base may not be great enough to enable the carbons of the arc lights, burning three hundred feet high in the air, to work easily. The impact of a storm rushing athwart the statue will not be trifling. The weight of the statue is about 440,000 lbs., and the materials are copper and wrought iron.

SUBTERRANEAN COMMUNICATIONS.

As detailed elsewhere in this issue, the sub-committees of the General Committee on Underground Devices have made their reports. They have apparently been busy, and it may be taken for granted that even if they had not voluntarily pressed their inquiries the hundreds of inventors of infallible underground systems would not have given them much rest. It is stated by the sub-committee on electrical and mechanical devices that they have examined over 600 patents and plans relating to underground electrical communications; and that, it would seem, satisfies them, although two or three hundred more await attention, according to the Patent Office statistics, and the resources of inventive genius are by no means exhausted yet.

Put briefly, the reports admit that the wires can be conducted under ground, but the only practicable device to accomplish the purpose would be a subway or tunnel large enough to give workmen access to the wires at any time. The question then arises: Who shall undertake this work? and the answer is that no laws exist under which a company can be organized to lay an underground electrical system and lease the wires. Leaving work of this kind to the city government is not, however, to be thought of for a moment,

It is interesting to note that the presentation of these reports has sobered one or two of the vehement advocates of underground wires. The New York *Times*, after clamoring wildly for them says now: "It would obviously be wasteful to build one set of underground conduits to accommodate the wires and leave provision for the other requirements to be made separately when the need for them shall have become as pressing as is already the need for underground wires. This is the fact which may make us hesitate about ordering the wires down, and leaving it to the companies to find out what shall be done with them after they have been taken down."

That view of the case ought to have been clear all along. It is about time that a stop was put to the practice of ripping and tearing up the roadways every other month or oftener, but if all the electrical wires are to be buried, in the present condition of things, the streets must be in a chronic state of disrepair. Ten years ago there were only the telegraph wires to be considered, now there are as well telephone, time, messenger, fire-alarm and electric-light wires; and ten years hence there will probably be as many more applications, each requiring its own set of wires. Moreover, the number of buildings to be connected is largely on the increase, adding proportionately to the possibilities of damage to wires and disturbance to the thoroughfares.

The placing of these wires under ground is a very small part of a very important subject, and an arbitrary measure like the late ordinance against aerial electric light wires, passed by the Aldermen, or like the bill against all aerial wires passed by the State Senate but not yet adopted by the Assembly, does no good at all to anybody. Those provisions will be inoperative because the people will not submit any longer to the incessant opening of the streets that has already made New York a city worse paved than any tenth-rate European capital. When the wires go under ground here they will go in a tunnel or subway with the sewer pipes, water mains, gas mains, steam heating pipes, brine refrigerating pipes, pneumatic tubes, and the other conductors required by the growing modern system of central supply.

From an arrangement of that kind some satisfaction may be derived. Our English contemporary, the *Electrical Review*, says with regard to underground telephony, that at the present time lengths of over fifteen miles are in use in the telephone system of the postal department, the wire being a No. 20 copper, covered to No. 11 with gutta percha. Next week we shall publish an interesting article on the Brooks system, which is known to have many excellent features, and by which talking has been recently carried on in Philadelphia with ease over four miles of wire. Provided the insulation is so good that gas, steam and other agencies cannot injure it, and that the various wires are so led and grouped along the roof, sides and floor of the subway as not to affect each other, fair results may be looked for. But with the farmer in the old story, we would like to have a date fixed for that good time coming.

PREPARING FOR THE EXHIBITION.

We publish in this issue a map of Philadelphia that we have had specially prepared, showing the situation of the International Electrical Exhibition and of the chief buildings, railroads and memorials in that city. Having heard many persons express the desire to know as definitely as possible the topography of the city we thus endeavor to meet the want. The letterpress accompanying the map gives also a good deal of useful information.

The general interest in the Exhibition is becoming more and more marked among electricians, and it is likely to be increased by the action of the sub-committee of the House Committee of Congress on Commerce, respecting the Mutchler bill, of which some notice has already been taken in our columns. This bill provides for the appointment of a scientific commission to attend the Exhibition, and that the commission may invite scientific men, native and foreign, to participate in the conference. The commission may also conduct such special investigations both at and subsequent to the International Electrical Exhibition as may conduce to the progress of electrical science in this country. The bill appropriates $25,000, and requires that the work of the commission shall be completed within three years after the passage of the act. On this the sub-committee reports favorably, and it is believed that Congress will make good use of at least this small portion of the surplus revenue.

We observe that some discussion has arisen as to the propriety of the determination arrived at by the committee on exhibitions not to award medals or premiums. Instead of receiving medals the exhibitors are to receive reports made by a carefully chosen board of examiners, under the signatures of the examiners and issued with the official sanction of the Institute after thorough investigation. The latter method certainly strikes us as the better of the two, and we think that it will justify in operation the decision of the committee. Medals have lost much of their significance and special value, and are often regarded with a prejudicial and damaging skepticism, while the reports of the examiners will, on the other hand, be a most valuable series of documents from which exhibitors can derive solid satisfaction. The only objection of great validity that we see to the report system is that it will necessarily entail very heavy work on the examiners. It is much easier to walk around and then stick the prize ticket on an article than to explain at length and with precision, in a formal memorandum, all the reasons that make the exhibit worthy of notice. There may be some little trouble in getting judges who are competent and willing to do so much.

Slow Engines for Electric Lighting.

It is a fact well known to experts and others who use the electric light, says the Detroit *Free Press*, that the generator requires to run at very high and nearly uniform velocity. The "approximate" of revolution has heretofore been accomplished by the use of very high speed reciprocating engines to overcome the check that the crank of the engine receives at each end of the piston stroke, and which check produces the flicker in the light.

To overcome this trouble a class of engines made by only three or four manufacturers in the United States has come into use. These engines are especially intended for transmitting uniform motion to the generators of dynamo machines, and they are very expensive, both in first cost and subsequent maintenance, as they require an expert and superior mechanic to keep them in good running order. To this may be added the fact that very large engines cannot be run at high speed, so that an engine of sufficient capacity to light a big section of the city cannot be used for this purpose. All the efforts heretofore made in that line have been by the employment of a number of small engines to furnish the requisite power, as not more than two dynamos can be driven, as at present used, by one engine. It will thus be seen that great expense and complication stand in the way of using the electric light in a central system. To obviate these difficulties a device has been invented by J. R. Marple and J. P. Wayne, of Detroit, and a test plan of fifty lights has been in operation during the winter, which utilizes a slow-running engine in connection with the patented device for giving the uniform motion that is absolutely necessary to the generator of a dynamo machine and produces a light of great steadiness and brilliancy.

This device consists in using a countershaft on which are a fly wheel and small friction wheel driven by a larger friction wheel on the engine shaft. A very rapid motion is communicated to the countershaft, which, being in connection with the running engine shaft by means of the friction wheels above mentioned, is used to control the motion of the crank and thus prevent checking at each end of the piston travel. The result is a steady round motion, communicated to a slow moving engine, a desideratum never before achieved for this purpose. The following figures are applicable to the plant in use at the Fulton Iron & Engine Works, at the corner of Brush and Woodbridge streets:

Engine six-inch bore, eight-inch stroke:
Number of revolutions of engine 120
Number of revolutions of counter shaft 840
Number of lights 50

The engine is known as a common throttle engine without cut-off and using a Judson governor.

The Signal Service in New York.

A writer in the New York *Mail and Express* makes the following notes on the Signal Service station at 120 Broadway:

The sun shone so brightly this morning that the novelty of having fine weather impressed everybody, and I climbed to the Signal Service tower, at number 120 Broadway, to ask Young Probabilities, who was in charge, whether it is true, as I have heard, that we have had only eight or ten full days of clear weather this year. He said that was about correct, but he could not say positively, because his books had been taken to court. It seems that the federal and municipal authorities are in the habit of borrowing the meteorological record for use in their own defense when suits of certain classes are brought against them. On the other hand, any citizen can get the record of any specified time by writing to Washington for it. Every station sends its observations to Washington three times a day, and then all over again once every month. New York is a station of the first class, and is manned by six young probs., who must be educated young men and yet enlist, regularly, in the army like common soldiers. If they are college graduates they simply submit an essay on some scientific subject; otherwise they must submit to a rigorous examination. Then they are sent to a preparatory school near Washington, trained in the science of meteorology and in the use of the exceedingly simple though delicate instruments by which rain fall, wind force and atmospheric pressure are measured, and after that they join all the other junior probs. in sending their local observations to headquarters where, in a building whose roof fairly flutters with revolving cups and bobs, Old Probabilities makes up his diurnal hypothesis.

The American Institute of Electrical Engineers.

We understand that the Committee on Organization, appointed at the meeting of the 15th inst., is actively at work, and will soon be ready to call a meeting for the consideration and approval of its deliberations, the election of officers and admission of members.

PAPER-PULP INSULATION.—Paper-pulp impregnated with liquid silica has been introduced as an insulator for covering electric-light wires. The pulp is now made by macerating straw or wood in dilute milk of lime, and after twelve hours digesting it with sulphurous acid under a pressure of four or five atmospheres. In two hours the material is loosened, and after being washed in water and again treated under pressure with three per cent. of chloride of calcium, and a half per cent. of aluminium sulphate, dissolved in a little water, the stuff obtained resembles cotton, and serves for the manufacture of fine cotton.

Sheehy's Switch Board for Electric Light Stations.

At stations for the production of electricity for distribution by means of a considerable number of circuits and to be used for industrial purposes, several dynamos are provided; and in well-appointed stations some extra ones stand ready to be applied at a moment's notice, to supply deficiencies which arise either from accident or extraordinary calls for more electric current. Furthermore, it often becomes

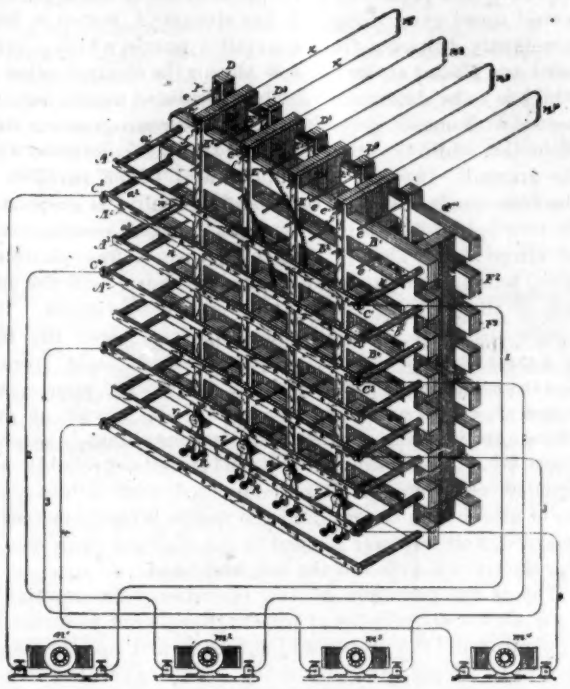


FIG. 1.

necessary to switch the current of one dynamo from the circuit which it is at the moment, or has been, supplying, to another circuit.

With currents of high electromotive force this switching is attended with some considerable danger from shock. Therefore, a handy apparatus which can be employed by the person in charge without danger, and with certainty and celerity, is a very desirable addition to the station; especially so in stations for supplying electricity to arc-light circuits.

Mr. Robert J. Sheehy, who has been long and favorably

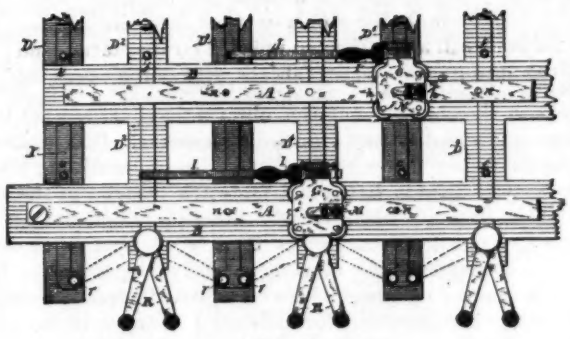


FIG. 2.

known in connection with the Brush system of arc lighting, has patented such an apparatus, and we herewith give some illustrations of it.

Fig. 1 shows a wooden frame carrying a series of horizontal metallic bars which are connected alternately with the opposite poles of the dynamos. A like number of bars perpendicular to these are connected with the terminals of the lamp-circuits. Metallic pins project from these latter bars. Carriages *G*, Figs. 2 and 3, slide along the former bars *A*, and carry arms *I*, and spring sockets *i i*, which fit the pins *f f*. One of the handles *M* to each carriage is for

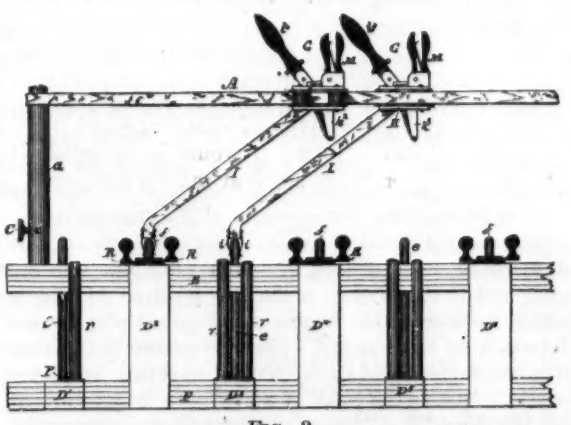


FIG. 3.

the purpose of fastening or loosening in placing or moving the carriage along the bar; and the other handle is for the purpose of shifting the socket arm *I* from p in to pin a desired. The switch handles, *R R*, enable the placing of two or more circuits in series. In fact, all the necessarys combinations and changes can be made in the circuits by means of this switch-board.

The distances apart, isolation, and insulations of the parts enable safe manipulation, where otherwise might be danger and the formation of destructive cross-arcs to burn up the switch board. K.

The Underground Wires Problem in New York.

About a year ago a general committee was appointed to consider the feasibility of putting the wires used for electric light, telephones, messenger calls and telegraphing under ground. Representatives from all New York companies interested in electric wires of any kind were invited to co-operate. After several meetings had been held three sub-committees were appointed—one upon Electrical and Mechanical Devices, one upon Law and Franchises, and one upon Business Organization. The first committee reports, in a communication just made to the general committee, that it has examined more than 600 patents and plans for underground electrical communication, tried and untried, and finds that a tunnel large enough to allow all the wires to be placed so that they could be examined or repaired presents the only solution of the problem. The Committee on Law and Franchises reports that no law exists under which a proper conduit could be constructed and managed by a company. The Committee on Business Organization reported that there is no law which authorizes the formation of an independent company to construct, own and lease the lines of an exclusive system, and that serious impediments to placing conduits of sufficient capacity for such inclusive system already exist in those parts of the city where the demand for very extensive accommodation is imperative and rapidly increasing. The committee, therefore, recommends that the general committee apply to the Legislature of the State of New York for the creation of a commission having powers similar to those conferred by the provisions of the Rapid Transit act of June 18, 1875, and for the repeal of all acts inconsistent therewith. That commission might be placed in possession of all the correspondence and material collected by the sub-committees during the past year to facilitate and abbreviate its work. That commission might determine upon authorizing a private company and to lay down an inclusive system, as provided in the instructions to the sub-committee, or the adoption of the plan contemplated by several London parishes—that is, for the municipal authorities to lay down an inclusive system fully provided with wires for all purposes, renting them to the respective corporations and to individua's at about the cost of maintaining the present separate aerial systems. This would be a profitable property to the city, and, while contributing to lighten the burdens of municipal taxation, would extend the business of the telegraph, telephone, alarm, light and time companies rapidly and enormously, would thus diminish the proportionate cost of performing the service and promote the convenience of the public; the disturbance of the street would be minimized, and the responsibilty for their condition placed in the hands of those most competent to the charge.

We are informed that in a short time a meeting of the general committee will be called to take action in the premises.

Ocean Telegraph Stations.

It was lately suggested in these columns that one solution of the difficulties of ocean telephony might be found in resorting to buoyed relay stations. A Frenchman by the name of Menuisier has, it appears, elaborated some such daring scheme, for the purpose of enabling vessels in mid-ocean to communicate with the shore. His plan is to have, say between Bordeaux and New York, vertical cables at regular distances of sixty leagues, and connected with the main cable. To the right and left of the principal cable he would lay two branch cables, ten to twenty leagues each, ending in a vertical cable with buoys. These branches would form two crosses with the main cable. The chances of ships sighting buoys would thus be frequent. Each buoy has a number, and its position in mid-ocean is known from special tables. When a ship passing near a buoy wishes to telegraph, it connnects its apparatus wire, one with the wire of the buoy, the other with the buoy itself, which serves as an earthwire. The buoys are to be luminous at night and vocal in fogs. It is to be feared that this new scheme for "tapping the wires" will not work successfully.

Cincinnatians Studying Electricity.

Progress made by the new electrical society at Cincinnati is thus reported by Messrs. C. E. Jones & Bro.: "We are getting along very nicely at our class; the interest keeps up amazingly. The members are going through with the study of the subject in a very thorough manner. We are about to construct, for the benefit of the class, a combination secant, sine and tangent galvanometer. It will not only have these three methods of making tests, but it will also be adapted to measuring currents, from the feeblest and most delicate to the most powerful electric light or dynamo current. The base, frame and rings for the coils of wire will all be made of brass, and the brass will be as near chemically pure as it is possible to get it. The wire on the coils will be made specially for the purpose, and all necessary measurements of the coils will be put to a good many severe tests by Wheatstone's sliding bridge, now at our University. We expect to make it the finest instrument of the kind, in fact. We think it will be the only one with such combinations in this country."

REVIEWS OF NEW BOOKS.

ABSOLUTE MEASUREMENTS IN ELECTRICITY AND MAGNETISM. By Andrew Gray, M. A., F. R. S. E., Chief Assistant to the Professor of Natural Philosophy in the University of Glasgow. London: Macmillan & Co., 1884. 16-mo. pp. 207, price $1.

This is the handiest book we have seen on the subject of electrical and magnetic measurements in all electric systems. It is not only handy but comprehensible to the reader because the author begins with the beginning of the art and leads the student from elementary principles to mathematical demonstrations. He is told how the instruments are made and wherefore, from the standard magnetometer, which is the fundamental measuring instrument in the determination of the magnetic couple of the earth, to the various galvanometers which are used in measuring differences of potentials, currents and electrical energy.

A rehearsal of the heads of chapters will convey an idea of the scope of the book :—"Introductory; Determination of the Horizontal Component of the Earth's Magnetic Field; Absolute Units of Magnetic Pole, Magnetic Field, and Electric Current; Measurement of a Current in Absolute Units, and Practical Construction of a Standard Galvanometer; Definition of Absolute Units of Potential and Resistance, and Derivation of Practical Units—Volt, Ohm, Ampère, Coulomb; Description of Sir Wm. Thomson's Graded Galvanometers; Graduation of Sir Wm. Thomson's Graded Galvanometers; Potentials and Currents in Derived Circuits; The Comparison of Resistances; Measurements of Energy in Electric Circuits; Measurement of Intense Magnetic Fields; Dimensions of Units of Physical Quantities;" and some tables of sizes and conductivities of wires, and of electro-chemical and thermal equivalents.

The book is written for the advanced student who has mathematical education enough to enable him to understand the equations, and will prove a valuable hand book for him in the laboratory. A doubt as to the absolute reliability of these equations, as printed, is present with us because we find a long table of *errata*, which table goes to show that the proof was poorly read or that the equations were carelessly made. The fact that the book has been reread, and the numerous mistakes found which are printed in the *errata*, gives us somewhat more confidence; but that is not fully restored, because we have found typographical or (shall we say it?) authorial errors ourself. Of all things mathematical formulas and equations should be printed correctly. Mere typographical errors or those of expression in ordinary language are easily perceived and do but little harm, but mathematical errors are misleading and annoying. K.

ENERGY IN NATURE, being, with some additions, the substance of a course of six lectures upon the Forces of Nature and their Mutual Relations, delivered under the auspices of the Gilchrist Educational Trust, in 1881, by Wm. Lant Carpenter, B. A., B. Sc., Fellow of the Chemical and Physical Societies and of the Society of Chemical Industry. Cassell & Company, Limited, London, Paris & New York, 1883. 12 mo., pp. 212. Price $1.25.

This book is bound in good style, well printed on good paper with clear type and illustrated by 81 cuts. The heads of its six chapters are: Matter and Motion; Force and Energy; Heat a Form of Energy; Chemical Attraction, Especially Combustion; Electricity and Chemical Action; Magnetism and Electricity and Energy in Organic Nature.

To the student in electricity we have to say that he deals with but the one manifestation of energy and that he has but a very incomplete grasp of the principles of his art if he does not possess a fair knowledge of the correlation of the forces or, better said, of the conservation of energy. This book skims over the ground in a very pleasing, comprehensive way, and will serve to whet the appetite of the reader for deeper knowledge in the same direction. It is not too scientific (in the sense deplored by the beginner) and still is correct in statement. Buy it. K.

Photographing Atmospheric Electricity.

We are indebted to the Boston *Advertiser* for the subjoined highly interesting details as to the result of methods adopted at Harvard for measuring and recording atmospheric electrical changes. It will be remembered that during the fall of 1882 the United States government sent Prof. Henry Rowland of Johns Hopkins University and Prof. John Trowbridge of Harvard College to represent this country at the conference of electricians held in Paris at that time. One of the questions brought before the conference, and which received special attention, was that of "atmospheric electricity." The representatives of the United States were prominently in the discussion which then took place, and were selected by the conference as a committee to further investigate and report. It was proposed to have a series of observations taken in different parts of the world, and, through the co-operation of the different nations, it was hoped much would be accomplished. More particularly was the question as to the value of such a knowledge for meteorological purposes brought up, and, on the return of Prof. Trowbridge, at the request of the United States Signal Service, a beginning was made. It is now over a year since the first observations were made, and the work has been steadily continued. The purpose of the work was to get some measurement of the changes in the electricity of the air constantly going on. The method employed was what is known as the Thomson method (after Sir William Thomson). The apparatus employed is exceedingly expensive and delicate, and in some of the instruments actually used the nicety of adjustment is so fine that a millionth part of the charge of the smallest distilled water-cell is easily measured. The opening of a door in a far-off corner of the building is sufficient to instantly deflect a delicately suspended aluminum needle seven or eight inches, and the approach of a person in the neighborhood of the apparatus would upset everything. A fine stream of water is kept constantly dropping from a metallic nozzle which is insulated and placed at the point in the air the electrification of which is to be determined. This insulated nozzle is connected with one set of quadrants in a Thomson quadrant electrometer, while the other set of quadrants is connected with the ground. Between the upper and lower surfaces of the four quadrants, and running diagonally, is suspended by two spider-lines a figure "eight" shaped needle, made of aluminum. This is connected with a fine platinum wire, which dips into a jar of pure sulphuric acid, the outside of the jar being carefully covered with tin-foil. The needle also carries a small concave mirror about the size of a gold quarter-dollar. A fine beam of light from a distant gas-flame is reflected from the mirror upon a prepared sheet of sensitized paper, and the record of any change in the place of the needle is thus obtained by photography. A very fine battery of 144 cells—probably not equaled elsewhere—is kept connected with a charging point attached to the jar, and the needle is thus constantly charged, and responds at once to the slightest variation in the electric condition of the neighborhood.

This is the principle of the operation. In practice it took almost six months of patient, hard work to make the apparatus and the proper adjustments, and special means had to be adopted and originated. The apparatus in use has several new points in its arrangement that will undoubtedly be of great value for future work. A continuous photographic registration of changes in the electricity of the atmosphere has never previously been attempted in this country, but once at Kew, under Sir William Thomson and Mr. Balfourt Stewart, and a year ago or so, at Paris, by Mascart. While both of these attempts attracted great attention from the scientific world, and have yielded good results, it is believed that the arrangement at Harvard is superior in many points. As a specimen of the value of these electrometrical records to the ordinary reader, it is stated by Prof. Trowbridge's assistant, Mr. Alexander McAdre, of the signal office, that a change in the direction of the wind is often indicated several hours, frequently four or five, in advance, by a change in the state of the electric potential of the air. Rainy weather and coming storms are also foretold by the changes, but the observations are not yet full enough to lead to any decided statements. Observations are also being made with a view to determining what influence altitude has on the electric charge of the air, and instruments have already been placed on the top of the new physical laboratory. It is a work of great delicacy, and some time must necessarily elapse before the great mass of results can be worked up. It seems, though, to be the coming thing for indicating changes in the weather. It has already given good evidence of its ability to foretell changes, not only in the direction of the wind and of the humidity of the air, but also of the other more involved factors which must be taken into account in forecasting the weather. The idea of using it in connection with weather forecasts is entirely original in this country. A duplicate arrangement has already been set up, using a fine Thomson attracted disc electrometer, for the purpose of comparing the electric condition of the air at a distance, and it is expected that, in a short time, the signal government will set one up in Boston for practical use.

Simplifying the Telegraph Signals.

Reports from Boston state that a new telegraph system by which the present code is simplified has been exhibited there. Chemically prepared paper, moved by clock-work, receives the record of signals sent over the lines, which are represented by dots and dashes as in the Morse code. On the moving strip of paper rest the points of six fine iron wires or styluses, and the chief feature of the new system consists in enabling the operator at the transmitting station to make a signal through whichever one of the six styluses he may choose, although only one line wire is used, and in this way to make the position of the mark which is recorded in the chemical paper play a part in determining its meaning. The new system is the application to telegraphy of the system of notation employed in music. Just as the pitch of a half-note is determined by the bar in which it occurs, so a telegraphic character is by this method given six different meanings, according to the stylus through which it is sent and the position in which it is recorded, as in phonographic shorthand. The bars of the staff are ruled by copper styluses, which make a red line on the receiving strip as it is moved forward, a constant current from a local battery being passed through them for this purpose. When a message is to be sent by hand six keys are used at the transmitting station, each corresponding to one of the styluses at the receiving station, or one key pivoted to swing easily over six contact points may be employed. As each signal has six different meanings, according to the bar on which it occurs, only one-sixth as many are required as in the Morse system, and for these the shortest and simplest are selected. Thus, a dot is used for the six letters which occur most frequently. In this way the actual time occupied in making the signals required to send such a message, it is claimed, is reduced fully one-half from that required by the Morse system, so that the speed of transmission is doubled. Among the advantages claimed for the new system are the readiness with which it is learned, the ease with which a message can be translated after it is received, and the impossibility of stealing it from the wires during transmission by the use of a sounder. The process of sending messages has been still further simplified by a machine just completed, in which each letter is given a separate key, by the depression of which the proper signal is sent over the wire automatically, thus requiring no more skill to send a message than to operate a type-writer.

This method of application has been devised by Mr. A. L. Parcelle, of Boston, and the apparatus is the invention of Mr. Albert Storer.

The New York Electrical Society.

Dr. P. H. Vander Weyde, Mr. N. S. Keith, and Mr. F. W. Jones, the committee on the Jones award of $20 for the best paper read before the Society by any of its members, within the next three months, have reported their conclusion, which is, to leave the choice of subject entirely to the writer. It is hoped that this will induce such members as may have devoted themselves to original investigations of any branch of Electrical Science, to bring forward some new theory, fact or application. In this way the interest in the meetings may be increased by eliciting discussions, and something may be contributed to the general progress of Electrical Science, which, notwithstanding all it has already done for human progress, will certainly do a great deal more. Papers are to be sent to the President of the Society, No. 36 Cooper Union, before the second meeting in May, 1884, so that times of reading may be assigned.

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way, to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

45. WINDING COILS.

"What is the method generally used in winding up coils of fine wire, to have them solid and even, like spool-thread; and can it be accomplished by simple means?" J. M. B.
NEW HAVEN, CT.

Manufacturers generally have a spindle which is turned by hand, for the purpose. The spindle is run faster than the hand-crank by means of multiplying gear-wheels, and it has on one end a proper chuck to hold the spool, or the iron core, as the case may be. If an iron-core, washers of metal or other material are put on it at proper distances apart to constitute the length of the electromagnet. Then paper for insulation is evenly wrapped around the core, and the first layer of wire is carefully wound over that by turning the crank by one hand and guiding the wire by the other. The spool should be turned over from the operator so that the lay of the wire can be watched, and made as close as possible, while the wire is kept taut by the hand holding and guiding it. With care, two or three layers more can be wound over the first, and then, while the crank, or gear-wheels, is held by a stop and the wire fastened taut, a strip of paper of the width of the space between the washers is wound once or twice around the layers of wire, and the winding is resumed. Another layer of paper is put on whenever the layers of wire assume the least irregularity, because it furnishes a new plane surface upon which to wind. A little care and experience will enable one to wind a presentable coil. The wire coil from which the winding is done should be on a spool or reel, See the *Patent Record* on the last page of this week's issue of the WORLD for a new mode of winding. K.

46. COMPOUND MAGNETIC CORE.

"Has the experiment of magnetizing a rod of iron composed of three parts (two hollow and one solid) been tried? And would the inside rod show, by the galvanometer, as much magnetism as the outside rod?" X.
HONEOYE FALLS, N. Y.

For a given mass of iron the hollow core is the strongest. Another iron tube placed within the first tends to act as an armature to the first,—joining its two poles by a mass of iron. A rod of iron within the second iron tube tends to weaken the first and second still more. These conditions are the ones which exist below magnetic saturation in the three cases. But with increased mass of iron within the electro-magnetic coils more current may be utilized for magnetic effects and the innermost iron rod will then show magnetism, which will be more strongly exhibited if the end of the rod project beyond the tubes. The rod will show magnetic effects, but if the magnetizing currents be weak it will have opposite polarity to that of the tube. A galvanometer, as such, is not a test for magnetism. The needle of a galvanometer, or of a compass, may be used to test for the existence of free magnetism; but it is better not to so use a galvanometer because of the liability of changing the polarity of its needle, as well as its magnetic moment. K.

THE TELEGRAPH.

ANOTHER WESTERN UNION MAN RESIGNS.—A dispatch from Pittsburgh, Pa., says: "Benjamin F. Lloyd, manager of the Western Union Telegraph Company in this city, has resigned to accept the Division Superintendency of the Baltimore & Ohio Telegraph Company. His headquarters will be at Newark, O."

POSTAL TELEGRAPHS.—A dispatch of the 22d from Washington says: To-morrow the House Committee on post-offices, which has obtained permission to sit during the session of the House, will begin the preparation of a postal telegraph bill. It will be completed in a week. It will provide for contracts with existing telegraph companies for service, but it will not contain the provision in the Senate committee's bill for the erection of lines to piece out existing systems.

WESTERN UNION LIBERALITY.—The Advisory Committee appointed by Mayor Edson on February 14 to confer with representatives of various commercial exchanges of New York city with reference to the distribution of funds, clothing, etc., collected for the relief of the sufferers by the floods in the Southwest, has reported to the Mayor that $50,158,84 was disbursed. The committee expresses its admiration for the open-handed liberality of the merchants and citizens of New York, and its gratitude to the Western Union Telegraph Company, which, unsolicited, placed its wires at the service of the committee.

APPROVING THE CONTRACT POSTAL SYSTEM.—The House Committee of Congress on Post Offices and Post Roads, by a vote of ten yeas to one nay, adopted, on the 18th, a resolution declaring it to be the sense of the committee that it is expedient to adopt the contract system of postal telegraphy. The subject will be further discussed by the committee at its next meeting, and steps will be taken to formulate a bill. The chief contract plan before the committee is that of the Postal Telegraph Company. Mr. G. G. Hubbard's plan provides for buying out existing lines. Senator Edmunds' bill provides for the building of lines by the government.

A NEW LINE IN THE NORTHWEST.—A syndicate of capitalists of Minneapolis, consisting of Thomas Lawry, R. B. Hankinson, R. M. Towne and F. B. Gilson have formed a stock company with $500,000 capital to build a line of telegraph from Chicago to St. Paul and Minneapolis, via Madison, Wis. Two wires are to be strung, work beginning at Madison and construction to be pushed both ways as well as from each end of the line. It is also rumored that it is part of the plan to extend the line from Minneapolis to Omaha, but this is only in embryo as yet. The Chicago & Minneapolis line, when completed, which is to be by Aug. 1, is to be turned over to the Bankers and Merchants' Telegraph Company.

TELEGRAPHIC COMPETITION IN CANADA.—As was shown in the Montreal *Witness* recently, the Canadian Pacific Railway Company have on foot arrangements for carrying on public telegraph business. It is supposed to be by way of preparing for the new departure that a little pamphlet, without any sign to show who is responsible for its publication, has just been issued. It contains articles which have appeared from time to time in a Montreal morning paper expatiating on the blessings conferred upon the country by the telegraphic powers of the Syndicate, thus setting up competition against the monopoly of the Great Northwestern Telegraph Company. A preface states: "In order to more fully set them forth the within articles have appeared in the Montreal *Herald*." They are reprinted in another form, it is also stated, to rescue them from oblivion.

THE STRUGGLE IN NEW ENGLAND.—A dispatch from Hartford, Conn., says the application of the Baltimore & Ohio Telegraph Company to Judge Shipman, of the United States Court, for an order instructing Receiver Clark, of the New York & New England Railroad Company, to furnish transportation facilities for the construction of the Baltimore & Ohio Company's telegraph lines into New England, came up for hearing on April 18. The Western Union Telegraph Company appeared in court by counsel, and asked for a postponement for two weeks. Judge Shipman denied this motion and said they must be prepared to go on April 26, and if Gen. Swayne could not be present, the Western Union must secure other counsel. By the petition it appears that the Western Union claimed that the railroad had contracted with it to refuse all other telegraph companies such transportation facilities, and Mr. Chandler asked that the court make an order requiring the production of the exclusive contracts. Judge Shipman granted the request and ordered that the Western Union should serve the petitioners with a notice of the grounds of its defense and with a copy of the contract.

"ELECTRIC LIGHTS" AT BUFFALO, N. Y.—Perhaps the most brilliant assemblages of "Electric lights" ever seen in Buffalo, says the local *Courier* of the 20th, was that gathered at the Delmonico lunch-room at noon yesterday. There were present besides the lesser lights, Frank Kitton, chief operator of the Western Union; William Finn, chief of the Wheatstone automatic telegraph; Joseph W. Larish, electrician and local manager of the Baltimore & Ohio Telegraph Company; George A. Burnett, manager of the Northwestern Company of Canada; H. A Noss, manager of the Bankers and Merchants' Company of Buffalo; H. D. Reynolds, manager of the Postal Telegraph Company; F. W. Jones, chief electrician of the Bankers and Merchants' Company; and J. L. Curry, chief operator of the Great Northwestern Telegraph Company, of Toronto. The gentlemen were present Friday evening and listened with evident interest to Thomas Henning's lecture on the quadruplex at the Electrical Society's rooms, after which Mr. Jones gave some of the members a short sketch of the invention and introduction of that useful instrument, and referred to the fact as a matter of telegraphic history that the introduction of the quadruplex was largely due to the intelligent efforts of Messrs. Kitton, Heninng and Larish at Buffalo, which in the earlier days, as at present, was considered the most practical electrical school in the service.

THE TELEPHONE.

MR. L. G. HOUGH is appointed manager of the Indianapolis Telephone Exchange, taking effect April 16, vice Mr. Chas. S. Smith, who takes charge of the Operating Department.

THE TELEPHONE FOR LIFE-SAVING PURPOSES.—A cable between the life-saving stations on the New Jersey coast is being laid for telephonic communication. We expect to hear soon of the adoption of the American Portable Telephone Co.'s system for this purpose.

WESTERN APPRECIATION.—The Nebraska Telephone Co. will begin a thorough renovation of their Lincoln Exchange on 1st of May. They have 274 paying subscribers there, in a population of 16,000. In about two months they will make important changes at Omaha, General Manager Drake says.

A NEW ACOUSTIC TELEPHONE COMPANY.—Articles of incorporation of the New England Acoustic Telephone Company, of North Adams, Mass., were filed in the Hudson County Clerk's office in Jersey City, on the 18th. The capital stock is $1,000,000, and the incorporators are George Ward, of Boston, and Frederick P. Markham and William S. Johnson, of North Adams, Mass.

OPERA BY TELEPHONE.—Recently the Edison-Gower-Bell Telephone Company in Lisbon had the honor of transmitting the opera of "Lauriana" by telephone to the Ajuda Palace of the King of Portugal. As this was the first performance in Portugal of this opera, which is composed by a Portuguese, the King and court were much distressed at being unable to attend, owing to the recent decease of the late Princess of Saxony. However, the difficulty was overcome by transmitting the opera by telephone. So perfect was the audition by this means, although ten miles of wire were traversed by the current, that his majesty was able to hear and distinguish the words of the singers. The whole of the royal family and a distinguished company were present at the palace, ten telephone receivers being put up for their accommodation.

TIME BY TELEPHONE IN NEW HAVEN, CONN.—Mr. Fairchild, manager of the telephone company at New Haven, Conn., says of the new time service there, as already described by us: "The apparatus was put into the office by way of experiment. It is worked by batteries, and gives the hour and the minute simultaneously over all our circuits. To ascertain the precise time it is only necessary to step to your instrument. At the end of every minute there is clicked off the hour and then the number of minutes which have elapsed since the hour was struck. If it happens to be thirteen minutes past there is one beat, then a short pause, and then three more in quick succession. The attachment works successfully, and the only question about retaining it is the cost. The expense will be about $1,000 a year, and if our subscribers are willing to pay for the accommodation they can have it."

USEFUL ON THE RANCHES.—Mr. C. C. Annett, Manager of the Rocky Mountain Bell Telephone Company, has been traveling in his territory with a view to working for the establishing of a telephone connection between Cheyenne and Miles City, on the Northern Pacific. Telephone communication across the country between these points will prove of great value to the ranchers who have frequent occasion to communicate to each other on matters pertaining to stray and stolen stock; and the telephone will be a means of economy, as has been shown already in instances in Wyoming, where the owner of several ranches is enabled to personally superintend and give orders over the entire premises, thus dispensing with the services of a foreman at each point. Mr. Annett feels quite confident that the wealthy stock men through Northern Utah, Wyoming and Idaho will recognize the utility of the telephone and subscribe without being pressed.

TESTING THE STANDARD CABLE AT WASHINGTON.—A test of the Standard Underground Cable as used in Washington to connect telephonically the public buildings there was made last week by a number of scientists and electricians. Profs. Silliman, Barker, Young, Rowland and Newcomb took part, Gen. Meigs was also present, an interested spectator, while such practical electricians as Mr. Royce and Mr. Knap, of Baltimore; Mr. Marean and Mr. Kennedy, of Col. Rockwell's office; Col. Clarke, manager of the Baltimore & Ohio Telegraph Company, and Mr. Whitney, of the Western Union, were equally interested. Mr. W. J. McElroy, the electrician of the company, explained its workings in a graphic manner. To obviate any possible objections arrangemeets were made to use all the varieties of telephone procurable, and accordingly experiments were made with the Bell telephone, the Baxter, the Rogers, the Shaw and the Eccard instruments. All worked equally well, and one gentleman said he had not up to that time known the capabilities of his own telephone. A trial was also made by sending "Morse" over one wire while conversation was carried on with the other. The result was perfectly satisfactory.

THE ELECTRIC LIGHT.

FOR BABYLON.—An electric light company is being organized in Babylon, L. I., with $50,000 capital. The light will be generated by water-power from Blythebourne Lake.

THE BRUSH LIGHT IN FARGO, DAKOTA.—Fargo is lighted by the Brush electric light, on the principal streets and in the larger business houses, while a two hundred foot tower carries at its summit 20,000 candle-power lights to pour their radiance over the fair and prosperous little city.

GAS OUT OF FAVOR IN ENGLAND.—Mr. Robert Laird Collier, the well-known London correspondent of the Boston *Herald*, writes thus from that city: "In passing, I ought to say that gas is now wholly banished from all well-appointed private residences. A few houses have the electric light, but almost universally lamps and candles are exclusively used." The cheapening of the electric light very slightly will soon make it general in London homes.

A WELL-LIT FLEET.—A firm at Kiel, North Germany, now have twelve of their cargo steamers fitted with electric light apparatus. A description of one installation says that the dynamo is supplied with motive power by the steamer's machinery, and that the lamps are so fitted up as to allow of the display of one at the masthead while the other can be conveyed to the wharf for lighting up the warehouse alongside into which the cargo is being stored or from which it is taken.

NOT CAUSED BY ELECTRICITY.—The United States Illuminating Company have a station in the basement of the two-story brick building at 7 and 9 Elm street, owned by the A. T. Stewart estate and occupied by paper makers. At 10:30 on the morning of the 21st a fire was caused there, the firemen say, by the contact of two electric wires. The damage was $6,500. The chief clerk of the United States Company says that the officers do not see how the fire could be caused by an electric current, because the station is dead and electricity has not been generated there in two months.

BROOKLYN STILL PROCRASTINATING.—The Lamps and Gas Committee of the Brooklyn Council, represented by Aldermen Kane, Mathis and McCarty, held a brief session on April 18, and Alderman McCarty moved to lay over all applications in relation to electric lighting until the Legislature adjourns, that they might know first what is done with the bill directing the electric wires to be placed under ground. The petition of the Olmstead Electric Light Company and an invitation to the Aldermen to inspect its plant were read and ordered laid over. Without taking further action the Committee adjourned.

THE JENNY LIGHT IN NEW ENGLAND.—A new electric arc light is coming into the field here in New England, says the Boston *Manufacturers' Gazette*, and the first station is to be started at Brockton, Mass. This light is known as the Jenny electric light. It is well known in the West, where it is considered one of the best, and holds its own in competition with the Brush and Thomson-Houston Company systems. We understand they intend to push their business and are not afraid to enter into competition with any other light. This would seem to be the case, as they are to start in Brockton in competition with the Edison Company, and we hear they are talking of starting companies in Lawrence, Lynn and Springfield.

A PORTABLE ELECTRIC LIGHT PROMISED.—The Washington correspondent of the Augusta, Ga., *Chronicle* is responsible for the following: A civil engineer here, who has extensive scientific knowledge outside his own immediate professional domain, and who is now engaged in a colossal enterprise southward, tells me that very powerful improvements are being perfected in the electric light. He says an electric hand-lamp has been invented, the illuminating principle of which is generated by some simple chemicals that are ridiculously cheap and easily manipulated. A little sliding drawer at the bottom of the lamp holds the electric spark in solution, while, by simply touching a button, a magnificent light is developed or extinguished, as the case may be. This lamp does not specially differ in appearance from the ordinary kerosene affair, and can be used in the same way, but with a complete absence of trouble, odor or danger.

LIGHTING HOTEL BUCHTEL, AKRON, O.—The fine new Hotel Buchtel, at Akron, O., opened on April 16. It is lighted by the Brush-Swan incandescent system. The Akron *Beacon* says: The ordinary Swan lamp is of 16 candle power, but those which so beautifully lighted Hotel Buchtel last night were of 30 and 50 candle power. This is the first plant in this country that ever operated the 30 and 50 candle power lamps, and the result was satisfactory in every particular. Messrs. T. F. Cronise and E. W. Tesdale, of Salt Lake City, came all the way expressly to witness the exhibition, and expressed their entire satisfaction, as did all who noted its effects. These gentlemen are agents for the Brush light in the Rocky Mountain section of the country, and accompanied Mr. Wm. F. Swift, of Cleveland, Secretary of the Brush Electric Company. The arc lamps used in illuminating the hall in the Ayliffe Block, and also the viaduct spanning the street, performed their work perfectly. The one situated in the centre of the viaduct illuminated Mill street its full length.

SHEDDING LIGHT OVER THE CAPITAL.—A special dispatch from Washington of the 16th inst. says: The regular Wednesday reception at the residence of Mrs. A. A. Hayes to-night was a very enjoyable entertainment. Mrs. Hayes is the wife of the president of the Brush-Swan Electric Light Company. Like her husband, who is shedding light over the dark places at the capital, Mrs. Hayes has thrown a great deal of light and life into Washington society. She has gained quite a reputation among the ladies as president of a society for the prevention of cruelty to dumb beasts. The ladies of this society are very vigilant and have accomplished a great deal in the short time that they have been at work. Among the guests this evening were Count and Countess Lewenhaupt, Justice Bradley and wife, Mr., Mrs. and Miss Rockwell, Miss McCeney, Miss Gwynn, Mrs. Hogg, Miss Stevens, Miss Lee, Mrs. Laportas, Baron Schaeffer, Captain De La Clere, Messrs. Sanford, Saurin, Leiter. Harber, Davis, Webb, and Mr. Albert Pulitzer, editor of the *Morning Journal*, of New York.

PUBLIC LIGHTING IN NEW YORK.—The Gas Commission of New York City, composed of Mayor Edson, Comptroller Grant and Commissioner of Public Works Thompson, formally awarded on the 17th the contracts for lighting the streets, avenues and parks with gas and electric lights for the ensuing year, beginning May 1, 1884. The United States Electric Illuminating Company was awarded a contract at seventy cents per night for each lamp for lighting Battery Park, City Hall Park, Washington square, Tompkins square; Broadway, from Battery place to Twelfth street; Fifth avenue, from Washington square to Thirteenth street; Bleecker street, from Broadway to Eighth avenue; South street, from Whitehall to Grand; Eighth avenue, from Bleecker to Fourteenth street; Gansevoort Market square; East Broadway, from Chatham square to Grand street, and West street, from Battery place to West Eleventh street. The Brush Electric Light Company was given the contract at the above named price for electric lights in the following territory: Fourteenth, Twenty-third and Forty-second streets, from the East River to the Hudson; Fifty-third street, from Third to Ninth avenue; Seventh avenue, from Fourteenth to Fifty-ninth street; Broadway and Fifth avenue, from Fourteenth to Fifty-ninth street; Fourth avenue, from Eighteenth to Forty-second street, and Union and Madison squares.

MISCELLANEOUS NOTES.

THE ESTIMATED COST OF TELPHERAGE.—Professor Fleeming Jenkin lectured lately at Glasgow on the system of "telpherage," or electrical transport, which he has developed with the aid of

Professors Ayrton and Perry. He entered into a discussion of the cost of erecting and maintaining telpher lines as against the cost of cartage on common roads, the telpher train being destined, in his opinion, to take the place of the horse and cart, and serve rather as a feeder than as a competitor of the railway system. A telpher line of ¾-in. steel rods carried on wooden posts and properly insulated he estimated would cost no more than £500 per mile. He would put down £1,500 per annum for engine power for a 25-mile line. The cost of transport on such a line working eight hours a day, after making full allowance for interest on capital, for depreciation, wages, etc., should not, the lecturer stated, exceed ⅝ pence per ton per mile, a result which compares most favorably with cartage. The professor, however, omitted one item, namely, the cost of the land over which the line should run.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Wednesday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 56½; American Rapid, b 50, a 65; B. & M. Co., b 119, a 119½; Commercial Telegram Company Pref'd, a 70; Harlem District Telegraph Co., a 5.50; Bankers & Merchants' Telegraph Co. 1st. mtge bonds, a 85; Manhattan Telegraph, b 10, a 85; Mexican, b 123, a 147; Northern & Southern Tel. Co. 1st mtge bonds, b 74, a 78; Postal Telegraph (stock), b 7, a 7.50; Postal Telegraph bonds, 1st 6 per cent., b 56.50, a 57.50; Western Union, b 65⅝, a 65½.

The Committees on Securities, New York Stock Exchange, have issued the following: Referring to the circular of the Bankers and Merchants' Telegraph Company of March 19, this committee rules: "Sales of stock of this company, except for cash, made before fifteen minutes past two P. M. on April 18, the day of closing transfer books, may be with or without the right of subscription; on all sales with the right made previous to fifteen minutes past two P. M. April 18, and delivered after that date the seller must give the buyer a written agreement of right or a due bill for the same. The holder of a due bill must notify the maker on or before April 21 of his wish to avail of this right hereby making himself liable for all payments thereon as required. Either party may require deposits in trust company. The maker of a due bill may give an assignment of right in settlement of the same before April 21. This also applies to borrowed or loaned stock. After fifteen minutes past two P. M. on April 18 stock will be called exclusive of right. Any party giving an assignment of right shall be entitled to call for deposits in trust company to cover liability on subscription. Due bills will be payable April 21.

TELEPHONE.—American Bell, b 156, a 157; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Erie, b 28, a 35; Globe, b 7, a 8; Hudson River, b 60, a 90; Inter-Continental, b 95, a 1.25; Mexican, b 2.50, a 3.25; Mexican Central, a 2.50; Molecular, b 5.50, a 10; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, 50, a 80; Overland, b 8.50, a 17; People's, b 10.50, a 12; People's (N. E.), b 1.50; Shaw, b 20; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.25; West India Telegraph and Telephone, b 2, a 2.25.

It is stated that the Central Pennsylvania Co., of which Mr. Hiram R. Rhoads, of Williamsport, Pa., is president, has consolidated with the North Pennsylvania Co. The new company's name will be the Central Pennsylvania Telephone and Supply Co. Mr. Rhoads and his associates, it is understood, gave $200,000 or $210,000 for their new purchase. The capitalization of the new consolidated company is $1,000,000, of which $800,000 has already been issued. A portion has been placed as treasury capital for further development of the business.

The Boston *Advertiser*, of April 23, thus quotes the local market: Telephone stocks were stronger, Bell advancing 1¼ to 159; New England ¾ to 27¾; Mexican sold at 2⅜; Tropical at 2 7-16.

ELECTRIC LIGHT.—American, b 2, a 4; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, b 40, a 60; Edison, a 120; Edison Illuminating, b 55, a 75; Edison Isolated, b 55 a 90; Edison, European, b 8, a 15; Excelsior, a 35; Swan Incandescent, a 40; United States, a 95; United States Ill. Co., a 90.

It is said that the California Electric Light Company has declared a dividend of six cents per share.

BUSINESS NOTICES.

REMOVAL.—The well-known firm of Holmes, Booth & Haydens have removed from their old stand to 25 Park place and 22 Murray street, where their numerous friends are invited to call. The new quarters are roomy and commodious, and the firm will be enabled to conduct with comfort their growing business.

ZELL'S CLASSIFIED U. S. BUSINESS DIRECTORY.—This Directory, the only one covering the whole United States, is a really magnificent publication, and the sixth issue, just published being that for 1884, in many respects surpasses the earlier editions. It contains a classified list of banks and bankers, manufacturers, merchants, wholesale traders, jobbers, commission merchants, retailers. We have examined the electrical section somewhat closely, and find it fuller than any before submitted and as correct as any that we have yet seen. The work also contains lists of importers, manufacturers, bankers, etc., in South America, Australia, New Zealand, Great Britain, France and other countries. It is impossible to conduct business to-day without a Directory of this nature, covering all industries and occupations, and the low price of ten dollars places it within the reach of all wishing to use it. Anyone engaged in electrical pursuits will find the book an exceedingly valuable one, and will do well to send for it. The agents are H. A. Curtin & Co., of 5 and 7 Murray street, this city.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 237 Broadway, New York.

PATENTS DATED APRIL 8, 1884.

Apparatus for Distributing Fire Signals over Lines Employed for Other Purposes; Frank Waldo, of Washington, D. C., Assignor of one-half to Leonard Waldo, of New Haven, Ct..... 296,653

Consists in the application to a central-office system of lines normally grounded at the central office, and used for any form of electrical communication, of a common transmitting device controlled by a standard-time-keeper, and adapted to be at any desired moment included in the circuit common to all the wires, so as to send out electrical time-indicating impulses over all the lines simultaneously.

Automatic Telegraph; Rufus Anderson, of Peekskill, N. Y..... 296,376

Improvement in the apparatus for controlling the movements of drum and contact-roller in telegraph transmission, which depends upon insulating ink on the surface of a metallic drum.

Bracket for Insulating Supports for Electrical Conductors; David S. Haines, of New York, and Stephen D. Lake, of Brooklyn, N. Y..... 293,558

Brackets are made of malleable iron of suitable form for plane or corner, with holes to receive screws for fastening in place, and lugs or other devices to receive and hold insulating buttons or the like holders of electric wires.

Dynamo-Electric Machine; Edwin J. Houston and Elihu Thomson, of Philadelphia, Pa., assignors to the Thomson-Houston Electric Co..... 296,569

Consists in the combination, with two field-of-force poles, respectively of north and south polarity, of a plurality—that is a greater number—of armature coils or bobbins, so that the reversal of current shall take place successively and not simultaneously in all the bobbins, one-half of the terminals of said coils or bobbins being connected together or to a common conductor, while the remaining ends are separately connected to the separate segments of a commutator, to which are applied the brushes of the machine.

Electric Telephone Transmitter; James A. Maloney, of Washington, D. C..... 296,593

Variations in details of a carbon transmitter.

Electro-Magnetic Valve and Connection; Henry Flad, of St. Louis, Mo..... 296,549

This valve is used in electro-magnetic air-brakes, and is operated by an electro-magnet moving an armature attached to the valve.

Electro-Magnet Air-Brake; Henry Flad, of St. Louis, Mo..... 296,546

Consists in combinations of air-brake apparatus with electro-magnets and conductors by which the several valves are operated either simultaneously or at appropriate times.

Electro-Magnetic Brake System; Augustus L. Duwelius, Cincinnati, O..... 296,319

A dynamo on a locomotive is connected with electro-magnetic-brake apparatus on one or more cars, and with secondary batteries, so that when the locomotive becomes disconnected from the train the brakes may be operated by current from the secondary batteries, automatically or otherwise.

Electric-Magnetic Car-Brake; Harvey S. Park, of Henderson, Ky..... 296,349

Consists in the combination, within the frame of the braking apparatus, of two sets of electro-magnets, each having separate electrical communication with the generator, the electro-magnets being placed face to face, and having a clutch disk placed between their faces and upon the shaft which carries the drum upon which the brake-chain is wound.

Electrical Connector in Pipe-Couplings for Air-Brakes; Henry Flad, St. Louis, Mo..... 296,547

When the air-pipes of air-brakes are coupled in making up the train the process also makes, at the same operation, the suitable electrical connections. The wires are inside the pipes, and suitably insulated therefrom. In one form the conductors within the couplings are made to spring against each other longitudinally, end to end. The ends are enlarged to insure meeting.

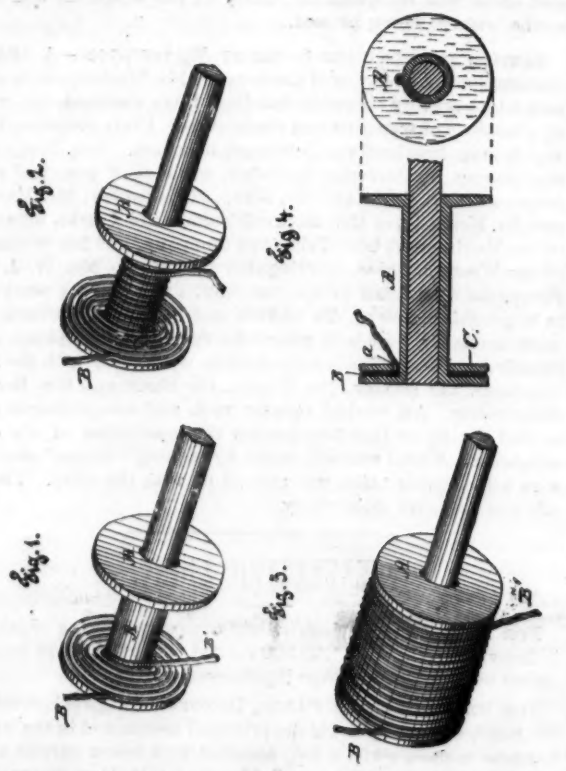
Electric Igniting Device for Gas-Engines; Hiram S. Maxim, of Brooklyn, N. Y..... 296,341

Within any part of the explosion-chamber of a gas-engine are placed two contact-strips, pins, or the like, one of which is connected with an armature of an electro-permanent magnet, so that when the armature is moved from the magnet the strips or pins are separated. The bobbin-wires of the coils surrounding the limbs of the permanent magnet are connected with the contact-strips.

These devices are so arranged that the armature will be encountered by the part of the engine designed for that purpose at the moment when it is desired to produce the explosion of the gaseous mixture under the piston of the engine.

Electric Helix and Method of Winding the Same; Forée Bain, of Minneapolis, Minn., assignor to The Bain Electric Company of Chicago..... 296,380

A represents an ordinary spool, around the barrel of which the wire is to be coiled. I first coil the beginning end *B* of the wire at one end of the spool upon itself, coil on coil, until it is built up to the required height, and leaving such end exposed, as clearly seen at Fig. 1. I then coil the wire *B'* upon the spool in the ordinary way, between the built-up portion *B* and the opposite end of the spool, as clearly shown at Figs. 2 and 3, until completed, as shown at Fig. 4, where it will be observed that both ends *B* and *B'* lie on the outside and are readily accessible, and that in the event of any breakage of such ends, as frequently occurs in continued handling, the beginning end *B* may be readily unwound to the extent of one or more coils, to furnish additional wire for connection, without in the least disturbing the coils of the remaining portion *B'* of the wire. The final end of the wire is obviously free



of access and readily unwound. In beginning, the method of winding the coils built up from the beginning end *B* of the wire may be sustained in position during the remainder of the method of winding by cementing said first coils to the head of the spool by any suitable glutinous substance; or, if desired, a separate disc head or partition *C*, Fig. 5, may be employed, as clearly represented in the drawings. When such partition is used, it may be rigid or movable, and is provided at its inner circumference with an orifice *a*, for the passage of the wire with which the final coils are made.

Galvanic Battery; Henry Thame, of Winders Road, High street, Battersea, England..... 296,365

The liquid in this battery consists of oxychloride of chromium (CrO_2Cl_2), for the prevention of polarization.

Insulating Support for Electric Conductors; David S. Haines of New York, and Stephen D. Lake, of Brooklyn, N. Y..... 296,688

Consists in two separate pieces or sections of insulating material, having grooves formed across their faces, and adapted to be fastened to a support, with their grooved faces confronting, by means of a screw passing through their centres and entering the support.

Individual Signaling Apparatus; Thomas D. Lockwood, of Malden, Mass..... 296,588

Consists in placing at the central station a suitable automatic transmitting device with controlling appliances, and at each sub-station a signaling-instrument adapted to follow and reproduce the movements of the transmitter, moving when the transmitter moves, and resting when it rests.

Lightning Arrester for Telegraph and Telephone Lines; John Griffin, Philadelphia, Pa..... 296,407

Fine platinum wires parallel with the axis of a reel connect the two sets of radial arms of the reel placed a short distance apart. The line wire is brought to a pin, and another pin connected to the wire running to the instruments is placed so that one of the fine platinum wires may press against the pins and thus complete the line circuit. When lightning discharge takes place the fine wire burns out; but the circuit is immediately restored by the next wire, which is brought into position by the rotary movement of the reel caused by a coiled spring.

Machine for Carding Buttons by Means of Electricity; Louis Gillon, of Les Lilas, France..... 296,401

The iron shanks of the buttons are caused to assume the proper position for pressing into the card by the attraction of electro-magnets.

Means for Supporting and Insulating Electric Wires; John Watson Tringham, of Windsor, Ontario, Canada..... 296,485

The arms of a bifurcated block are constructed to approach each other and clamp the line wire which is covered at that point by an insulating wrapper.

Morse Register and Perforator; Lorin C. Springer, of Hyde Park, Assignor of eleven-twentieths to Chancy G. Wright, of Chicago, Illinois..... 296,641

A single instrument is made so as to act as a receiver and a perforator of ribbons for automatic transmission.

Portable Electric Battery and Lamp; Charles G. Gumpel, of Leicester Square, County of Middlesex, England..... 296,331

Consists of a suspending-frame and a number of dishes piled one on the other within a case or frame, with their junctions made tight against leakage of liquid, each dish having tubular projecting bosses, through which pass rivets electrically connecting an electrode plate above the dish with a plate below. This secondary battery is combined with an electric lamp.

Process of and Apparatus for Reducing Metals by Electrolysis; Augustus J. Rogers, of Milwaukee, Wis., Assignor of two-thirds to Henry Mann and Julius Koebig, of same place..... 296,357

The inventor provides an apparatus for the reduction of metals from their fused oxides or salts, which consists of a melting pot over a fire, and a connected decomposing-tank within which the electrodes are located.

Receiving Telephone; James A. Maloney, of Washington, D. C..... 296,420

Claim.—"The combination, in a receiving telephone, of a non-magnetic diaphragm, a magnet, and a multiple-reed armature, under the arrangement and for operation substantially as hereinbefore set forth."

Swinging Brackets for Electric Lamps; J. Ritchie, Brookline, Mass..... 296,355

The bracket resembles in external appearance an ordinary gas-bracket, having one or more joints. The contacts within the joints are made by spring-like elongations of the conducting wires of one section pressing on the inner surfaces of two insulated rings, which are the beginning of the conductors through the next section of the bracket.

Telephone Transmitter; Sager Chadwick, of Philadelphia, Penn., Assignor of one-half to E. V. Machette, of same place..... 296,676

The diaphragm is made of hardened gelatine, prepared with chromic acid. The contact-point fastened to the diaphragm impinges on a block of soft gelatine made conductive.

Telephone Transmitter; James A. Maloney, of Washington, D. C..... 296,421

Iron filings are used between the carbon contacts.

Voltaic Pile; August Shroeder, of Stettin, Germany. 296,464

The bottom plate of the pile is provided with downwardly-projecting pins or points. The top plate is the cover to a tube of conducting material. The tube covers the whole series of plates, but is insulated therefrom by a rubber tube. The outer tube has points which are horizontally even with the other points. The object is to impart electricity to any material which the pile may be put upon.